

AMENDMENTS TO THE DRAWINGS

A replacement sheet of drawings is provided to add reference numeral 45 that pertains to a combustion supporting gas and to correct a typographical error with respect to catalytic burner 50 being improperly numbered "54" in Fig. 2.

REMARKS

By way of this amendment, claims 16, 21 and 25 have been amended, claim 23 canceled and new claims 27 and 28 added. Claims 16-22, 24, 25, 27 and 28 remain pending in the application. The amendments to claims 21 and 25 provide better antecedent with respect to the combustion supporting gas relative to the previously presented term of "combustible gas flow". Support for the amendment to claim 21 is found in original claim 23, now canceled. Support for new claim 27 is found in original claim 16. Support for new claim 28 is found at page 10, lines 6-11 and 17-19. Accordingly, it is submitted that no new matter has been added to the application by way of these amendments.

Currently all the pending claims stand rejected under 35 U.S.C. §103(a) over Towler et al. (US 6,409,974) in view of Holland et al. (US 6,572,837).

Reconsideration and withdrawal of this rejection is respectfully requested on the basis that neither prior art reference alone or in combination recognizes the efficiency of performing a secondary chemical reaction in the same volume the membrane separation is occurring. This recitation is manifest in claim 16 as a "secondary stage membrane reactor".

The basis of the rejection is that Towler et al. teaches all the limitations of pending independent claim 16 with the exception that "Towler fails to teach that hydrogen is passed through a membrane to thereby separate the hydrogen from the raffinate stream after the water gas shift reaction." (Paper No. 20090130, page 5, third paragraph). Holland et al. is cited to bolster the deficiencies of Towler et al.

Holland et al. is specifically cited for teaching:

a method for producing hydrogen (col. 1) wherein two reactions proceed, the first being a reforming reaction and the second being a water gas shift reaction, whereby the product stream of the water

gas shift reaction is purified by passing the hydrogen through a hydrogen permeable membrane and leaving the raffinate (col. 4, lines 15-26; col. 7, lines 46-61).

Holland et al. is cited for teaching most relevant to the pending claims as being that depicted at Fig. 2 and detailed in particular with respect to column 7, lines 46-65. With respect to this embodiment, Holland et al. teaches two hydrogen membrane separation devices in series with purified hydrogen output from each being supplied to a unit such as a storage tank or downstream equipment (column 7, line 51 – column 8, line 4). However, this reference per the Fig. 2 embodiment is wholly silent as to simultaneous performance of a chemical reaction occurring in one of the membrane separators. In the embodiment of Holland et al. where two stage reaction occurs, it is only taught with separate reaction (at reference numeral 110) and membrane separation (at reference numeral 106) and further requires a compressor (at reference numeral 112). Applicant hereby incorporates by reference the remarks made of record on December 23, 2008 with respect to this rejection. Additionally, Applicant notes that the claimed invention affords not only a simplified system through combining of a reactor (in which chemical transformation of the output from the first reactor occurs) and a membrane separator into a “secondary stage membrane reactor”, not least of which is through elimination of the need for a compressor, but also that the invention as currently claimed has the attribute of being load following. In contrast, the composite system formed through the combination of Towler et al. and Holland et al. is not load following. By way of explanation, and with reference to Fig. 2 of the claimed invention, which visually depicts in exemplary form the essential steps recited in claim 16, in the event that there is an increased demand for purified hydrogen, simply by increasing the feedstock metered to the endothermic reaction reactor, hydrogen output through the process of claim 16 occurs and is an attribute known to one of ordinary skill in the art as

“load following”. In contrast and with reference to the comparable two stage reaction system of the prior art combination that closely follows Fig. 1 of Holland et al., an increased demand for hydrogen at reference numeral 114 lacks this load following attribute since pressure continuity in the mixture side of separation membrane 108 is not in direct pressure communication with the remainder of the system but rather relies on the operation of compressor 112 to meter raffinate and output from the water gas shift reactor (at reference numeral 110) to the membrane 108. As a result, the combined teaching of Towler et al. and Holland et al. lacks the attribute of being load following per pending process claim 16. This attribute of the pending claim, along with the simplification and more efficient thermal operation of the claim process, are submitted to represent a surprising result to one of ordinary skill in the art upon evaluation of Towler et al. and Holland et al. Accordingly the recitation found within claim 16 that a purified hydrogen flow is collected from a secondary stage water gas step membrane reactor is entitled to patentable weight.

Applicant submits that pending dependent claims 17-22, 24, 25, 27, and 28 which depend from claim 16 are likewise entitled to patentable weight on the basis of dependency from claim 16, now believed to be in allowable form. Additionally, Applicant submits that additional bases exist for the patentability of the subject matter of the dependent claims separate from dependency from independent claim 16. Applicant reserves the right to make arguments of record in the due course of prosecution with respect to the separate patentability as to the subject matter of dependent claims 17-22, 24, 25, 27, and 28.

In light of the above amendments and remarks, reconsideration and withdrawal of the rejection as to claims 16-25 under 35 U.S.C. §103(a) over Towler in view of Holland et al. is requested.

Summary

Claims 16-22, 24, 25, 27, and 28 are pending in the application of which only claim 16 is in independent form. Entry of this amendment and the reconsideration and withdrawal of the rejection as to these claims and the passing of this application to allowance are requested.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 07-1180.

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Respectfully submitted,

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